Clinical Characteristics of Acute Heart Failure Patients

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Background: Hospitalized heart failure (HHF) is a challenging clinical entity in cardiology. Data on HHF patients from the Middle East is scarce. Observational studies may provide an initial insight that could improve disease management and guide the design of future clinical trials.

Objective: To evaluate the management, in-hospital mortality, and one-year readmission predictors of HHF patients admitted to the coronary care unit.

Setting: Coronary Care Unit, Salamaniya Medical Complex, Bahrain.

Design: A Prospective Study.

Method: Two hundred forty-five HHF patients were included in the study. Clinical data during hospitalization and upon discharge were recorded from 1 January 2012 to 31 March 2012. Follow-up was extended for 12-months for readmissions with heart failure (HF).

Result: One hundred seventy (69%) were males, and the mean age was 64 years. The main causes of HF decompensation were non-compliance 59 (24%), myocardial ischemia 51 (21%) and hypertensive crisis 39 (16%). Comorbidities included were systemic hypertension, 179 (73%), hyperlipidemia, 166 (68%), and diabetes mellitus, 161 (64%). The mean left ventricular ejection fraction (EF) was 34%. In-hospital mortality rate was 9.4%. Patients who were taking angiotensin receptor blockers (ARB) before admission had reduced in-hospital mortality. Upon discharge, 213 (87%) patients were taking renin-angiotensin system blockers, 170 (69%) were taking beta-blockers, and 66 (27%) were taking mineralocorticoid receptor antagonist (MRA). The rate of readmission with HF was 47% at one year.

Conclusion: HHF patients in this study have multiple comorbidities and an increased in-hospital mortality. In-hospital mortality-related variables and predictors of HF readmission should be verified in a larger population and employed in clinical practice, as these factors might help to improve patient outcome.


Heart failure (HF) is a major global problem1. Studies have helped in understanding this clinical entity and define areas where the quality of care is deficient2-5. The paucity of data outside of North America and Europe is the main challenge6. Shortcomings and barriers to the implementation of evidence-based therapy could not be analyzed without defining these types of gaps in knowledge.

Hospitalized heart failure (HHF) is defined as a new-onset or worsening (gradual or rapid) of HF signs and symptoms that require urgent therapy and result in hospitalization7.

The aim of this study was to evaluate the management, in-hospital mortality, and one-year readmission predictors of HHF patients admitted to the coronary care unit.

METHOD

All consecutive patients above the age of 18 years hospitalized with heart failure (HHF) from 1 January 2012 to 31 March 2012 were included in the prospective study; follow-up was extended to 31 March 2013 for readmissions of HF. The patients with the following conditions were excluded: severe aortic stenosis, severe mitral stenosis, peripartum cardiomyopathy, and heart failure due to medical illness (such as sepsis or thyroid disease).

The following variables were documented: age, gender, height, weight, body mass index (BMI), diabetes mellitus (DM), systemic hypertension (HTN), stroke, dyslipidemia, renal impairment defined as glomerular filtration rate (GFR)
< 60 ml/min, history of coronary artery disease (CAD) and atrial fibrillation (Afib), causes of decompensation, basic hemodynamic parameters (admission heart rate (HR) and blood pressure (BP)), hemoglobin and creatinine level, left ventricle ejection fraction (LVEF), medications, length of stay and in-hospital mortality. Upon discharge, basic hemodynamics (discharge HR and BP) and medications were documented. Compliance to medications was verified by reviewing the chart, follow-up visits, and central hospital pharmacy dispensary desk information. During the follow-up period, only some of the HHF patients were seen. Within each hospitalization, the same variables were traced. Ethical approval of the institute was obtained.

Statistical Analysis

P-value of <0.05 was considered significant. Frequencies, as well as differences between groups, were analyzed using Pearson’s chi-squared test or Fisher’s exact test. The analysis was done using Student’s t-test. Multivariable logistic regression (MLR) was performed to determine the predictors of readmission with heart failure and in-hospital mortality.

RESULT

The mean age was 64.5±13.5 years. One hundred seventy (69%) patients were male. HTN was the most common comorbidity, 179 (73%), followed by hyperlipidemia, 166 (68%), and DM, 161 (64%). CAD was seen in more than half of the patients, 127 (52%), more than one-third had renal impairment, 80 (33%) and one-fifth had Afib, 54 (22%). Twenty-four (10%) patients sustained a stroke, see table 1. The mean left ventricular ejection fraction (EF) was 34% (HF with reduced EF 60%, HF with preserved EF 16 %, and HF with midrange EF 24%), see figure 1.

Table 1: Clinical Characteristics of Patients Enrolled in HHF Registries and our Data

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Our Data (N=245)</th>
<th>Gulf Care (N=5,005)</th>
<th>EFICA (N=581)</th>
<th>ATTEND (n=1,110)</th>
<th>EHFS-II (N=3,158)</th>
<th>OPTIMIZE-HF (N=48,612)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, Years (mean)</td>
<td>64.5+_13.5</td>
<td>59+_15</td>
<td>73+_13</td>
<td>73+_14</td>
<td>70+_13</td>
<td>73+_14</td>
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<tr>
<td>Male</td>
<td>69</td>
<td>63</td>
<td>59</td>
<td>58</td>
<td>61</td>
<td>48</td>
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<tr>
<td>Ischemic Etiology</td>
<td>21</td>
<td>27</td>
<td>61</td>
<td>31</td>
<td>54</td>
<td>46</td>
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<td>Hypertensive Etiology</td>
<td>16</td>
<td>15</td>
<td>15</td>
<td>18</td>
<td>-</td>
<td>23</td>
</tr>
<tr>
<td>Comorbidities</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>DM</td>
<td>64</td>
<td>50</td>
<td>27</td>
<td>34</td>
<td>33</td>
<td>42</td>
</tr>
<tr>
<td>HTN</td>
<td>73</td>
<td>61</td>
<td>60</td>
<td>69</td>
<td>63</td>
<td>71</td>
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<tr>
<td>Dyslipidemia</td>
<td>68</td>
<td>36</td>
<td>30</td>
<td>37</td>
<td>-</td>
<td>32</td>
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<tr>
<td>CAD</td>
<td>52</td>
<td>47</td>
<td>-</td>
<td>-</td>
<td>54</td>
<td>-</td>
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<tr>
<td>Atrial Fibrillation</td>
<td>22</td>
<td>12</td>
<td>25</td>
<td>40</td>
<td>39</td>
<td>31</td>
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<tr>
<td>CKD</td>
<td>36</td>
<td>15</td>
<td>53</td>
<td>-</td>
<td>17</td>
<td>19.6</td>
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<tr>
<td>Admission HR</td>
<td>101+_24</td>
<td>97+_23</td>
<td>99+_29</td>
<td>95 (77-114)</td>
<td>87+_22</td>
<td>-</td>
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<tr>
<td>Admission SBP</td>
<td>155+_42</td>
<td>157+_34</td>
<td>126+_39</td>
<td>145+_37</td>
<td>135 (118-159)</td>
<td>140+_33</td>
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<td>Admission DBP</td>
<td>89+_22</td>
<td>81+_20</td>
<td>71+_22</td>
<td>-</td>
<td>75+_19.1</td>
<td>-</td>
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<tr>
<td>Ejection Fraction</td>
<td>34+_14</td>
<td>35 (25-45)</td>
<td>38+_15</td>
<td>-</td>
<td>38+_15</td>
<td>39+_17.6</td>
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<td>Creatinine</td>
<td>120+_60</td>
<td>130+_117</td>
<td>-</td>
<td>125+_140</td>
<td>-</td>
<td>156+_137</td>
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<tr>
<td>Hemoglobin</td>
<td>12+_2</td>
<td>12.6</td>
<td>-</td>
<td>12+_2.6</td>
<td>-</td>
<td>12+_2.04</td>
</tr>
</tbody>
</table>

Figure 1: Distribution of Enrolled Patients Based on Their Ejection Fraction

Precipitating Causes of Decompensation

The causes of decompensation were as follows: non-defined, non-adherence to medications, myocardial ischemia and hypertensive crisis, see table 2.

Table 2: Factors Identified as Precipitating Factors for HHF

<table>
<thead>
<tr>
<th>Factors Identified as Precipitating Case of HHF</th>
<th>Our Data (N=245)</th>
<th>Gulf Care (N=5,005)</th>
<th>EFICA (N=581)</th>
<th>EHFS-II (N=3,158)</th>
<th>OPTIMIZE-HF (N=48,612)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ischemia</td>
<td>21</td>
<td>27</td>
<td>42</td>
<td>30</td>
<td>14.7</td>
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<tr>
<td>Poor Compliance</td>
<td>24</td>
<td>21.2</td>
<td>7</td>
<td>22</td>
<td>11.1</td>
</tr>
<tr>
<td>Infection</td>
<td>11</td>
<td>15</td>
<td>20</td>
<td>17.6</td>
<td>-</td>
</tr>
<tr>
<td>Hypertension</td>
<td>16</td>
<td>8.2</td>
<td>8</td>
<td>-</td>
<td>10.7</td>
</tr>
<tr>
<td>Undefined</td>
<td>30</td>
<td>14</td>
<td>8</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Other</td>
<td>-</td>
<td>-</td>
<td>25</td>
<td>26.8</td>
<td>12.7</td>
</tr>
<tr>
<td>Arrhythmia</td>
<td>-</td>
<td>6</td>
<td>25</td>
<td>32</td>
<td>13.5</td>
</tr>
</tbody>
</table>

Figure 2: Hemodynamic Parameters for Admission and Discharge of HHF Patients

Systolic BP (SBP), diastolic BP (DBP) and HR were 155±42 mmHg, 89±22, and 101±24 beats per min (bpm), respectively. At discharge, SBP, DBP, and HR were 127 mmHg, 71 mmHg and 71 bpm, respectively; see figure 2.

All patients were admitted to the CCU. The average hospital stay was seven days, see figure 3. The mean hemoglobin was 12 g/dl and serum creatinine was 120 mmol/L, see table 1. Two-hundred-forty (98%) patients received intravenous loop
diuretics (furosemide) in boluses form, 29 (12%) had the furosemide as continuous infusions. One hundred seven (44%) received intravenous nitrates and 10 (4%) received inotropes. Twenty-four (10%) were mechanically ventilated. The rate of renin-angiotensin system (RAS) blockers, beta-blockers and mineralocorticoid receptor antagonist (MRA) had increased at discharge compared to the rate at initial hospitalization. The rest of the medications are shown in Table 3.

At one year, 115 (47%) patients had at least one readmission with heart failure. The following readmission predictors were identified by multiple logistic regression, including HR of ≥78 bpm at discharge (AOR) 2.36 (95% CI 1.37–4.07; p=0.05), diabetes mellitus (AOR) 1.88 (95% CI 1.01–3.24; p=0.05) and CAD (AOR) 1.81 (95% CI 1.04–3.40; P-value 0.05).

DISCUSSION

The mean age was 65±14 years, which was similar to other studies in developing countries. Patients in heart failure studies in North America, Europe, and Japan tended to be older. The regional age variation is well-known and can be partially explained by the prevalence of underlying risk factors in different societies.

Male predominance is almost a universal trend except in the Organized Program to Initiate Lifesaving Treatment in Hospitalized Patients with Heart Failure (OPTIMIZE-HF). Females constitute a large proportion of heart failure population in the United States.

Precipitating causes for decompensation for heart failure could reflect underlying etiology. Myocardial Ischemia represented 21% of the incidents, much less than reported in other studies. Administration of therapeutic heparin in 63% of the patients could indicate that myocardial ischemia is under-reported. Comorbidities can increase the risk of myocardial ischemia in this population. Underutilization of coronary angiograms and non-invasive workshops (such as coronary computed tomography angiogram or dobutamine echocardiogram) for myocardial ischemia during the initial admission might explain our findings.

In our study, HTN triggered 16% of the acute heart failure episodes. HHF is a common presentation of hypertensive crisis in Bahrain. DM was seen in 64% of patients. Across the spectrum of cardiovascular diseases, diabetes amplifies the risk and worsens the prognosis. More than 50% of the patients had CAD. We found CAD to be an independent readmission predictor for HF. One-fifth of the patients had Afib reflecting the high prevalence of systemic HTN in the cohort. Renal impairment was seen in 33%. Adding to its prognostic implication, initiation, and increase in evidence-based therapy could be limited in the presence of impaired renal function.

BP at initial presentation in our study was the highest compared to other studies. The mean LVEF was 34.4±14 SD with the majority being HF with reduced ejection fraction (HFrEF). Patients with HF of mid-range EF (HFMEF) comprised 26%; such category might represent an intermediate stage in the remodeling process of hypertensive heart diseases. The outcome of this group is to be verified by further clinical research.

Other than MRA, the rate of adherence to evidence-based therapy is observed in the majority of patients. Because 33% have renal impairment, the risk of hyperkalemia is a concern when using RAS blockers or MRA. In-hospital initiation of beta-blockers and angiotensin converting enzyme inhibitors (ACE-I) is an important predictor for long-term compliance for both and should be advocated.

The median length of stay was seven days, and in-hospital mortality was 9.4%. In other studies, the median length of stay ranges from 4 to 28 days and in-hospital mortality from 4% to 30%.
We found a median length of stay beyond seven days to be closely related to in-hospital mortality\(^1\). Studies with lower hospital stay have lower mortality\(^1\). Variables of mortality, such as age, HR \(>100\) bpm at admission, CAD, and non-cardiac morbidities are similar to other studies\(^2\). Our findings of reduced mortality with prior ARB therapy was similar to a study from Japan\(^3\). Readmission predictors in our study were as follows: HR of \(\geq 78\) bpm at discharge, DM and CAD. Predicting readmission is more challenging than predicting mortality due to HHF.

The limitation of this study was the small size sample. Bahrain has 1.2 million inhabitants. With an estimated heart failure prevalence of 2.5%, the total number of patients in Bahrain with this disease would be approximately 30,000. A sample of 245 patients has a 95% confidence level and 6.24 CI representative ability. In addition, the quality of documentation needs to be improved.

**CONCLUSION**

Our patients are relatively younger than those from the studies in North America, Europe, and Japan, and they had several comorbidities. In-patient mortality and 12-month readmission rates were 9.4% and 47%, respectively.

**Author Contribution:** All authors share equal effort contribution towards (1) substantial contributions to conception and design, acquisition, analysis and interpretation of data; (2) drafting the article and revising it critically for important intellectual content; and (3) final approval of the manuscript version to be published. Yes.

**Potential Conflicts of Interest:** None.

**Competing Interest:** None.

**Sponsorship:** None.

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**Ethical Approval:** Approved by Ethical Committee of the Secondary Care, Salmaniya Medical Complex, Bahrain.

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